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ABSTRACT

THIS MANUAL, PREPARED BY THE SCIENCE PROJECT RELATED TO UPGRADING CONSERVATION EDUCATION (PROJECT S.P.R.U.C.E.), CONTAINS SUGGESTIONS FOR INTRODUCING ELEMENTARY SCHOOL STUDENTS TO CURRENT ENVIRONMENTAL PROBLEMS. PROBLEMS TREATED ARE POPULATION DENSITY, SOCIAL POLLUTION, VISUAL POLLUTION, AIR POLLUTION, AND WATER POLLUTION. A BACKGROUND DISCUSSION OF EACH TOPIC IS FOLLOWED BY SUGGESTIONS FOR STUDENT ACTIVITIES AND QUESTIONS FOR DISCUSSION. MANY ACTIVITIES INVOLVE OBSERVATIONS IN THE LOCAL DISTRICT, SOME INVOLVE SIMPLE EXPERIMENTS. REFERENCES ARE MADE TO RELEVANT RECORDS AND FILMS, AND A BIBLIOGRAPHY OF PERIODICALS RELATED TO CONSERVATION EDUCATION IS INCLUDED. THIS WORK WAS PREPARED UNDER AN ESEA TITLE III CONTRACT. (EE)

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TEACHING TIPS

ON CURRENT

ENVIRONMENTAL PROBLEMS

Prepared by:

Project S.P.R.U.C.E.

SE 007 904

TEACHING TIPS ON CURRENT ENVIRONMENTAL PROBLEMS

A Curriculum Aid Prepared by Project S.P.R.U.C.E.

Project S.P.R.U.C.E.

(Science Project Related to
Upgrading Conservation Education)

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1969

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INTRODUCTION

Environmental problems surround us today. Conservation of our environment is of immediate importance to everyone if we are to continue to maintain fruitful lives.

Conservation could be defined as the recognition by man of his interdependence with his environment and the development of a sense of responsibility for maintaining his environment in a condition that will continue to sustain a high quality of life.

Man is the only organism doing irreparable damage to the environment even though he is aware of the consequences. Often he acts without knowledge of the disastrous results. He must accept the responsibility of thinking through the possible effects of whatever he does and modify his actions accordingly. This requires value-oriented decisions about how our resources may be used. The process of learning to make such decisions is begun while children are young.

In the past man has not always shown his acceptance of this responsibility. The age of technology has developed so fast that only now are we beginning to realize some of the damages man has wrought. Man has invented things that the environment can not absorb. He has tampered with the intricate balance of nature and has disrupted the interrelationship of all things in the environment. We need only look at the news headlines for proof of this.

The pollution at one source may not at first glance seem of significant seriousness but every small addition is a part of the whole that could ultimately kill mankind. Now is the time to do something. You may not agree with the sorry state of our environment but all must agree on the possibility of improvement. Students of today are the voters of tomorrow. They must be prepared to make intelligent decisions concerning the environment. For this reason we are now looking at environmental problems such as pollution. Perhaps we can learn to do something about it.

Sigrid Barker
Teacher - Naturalist

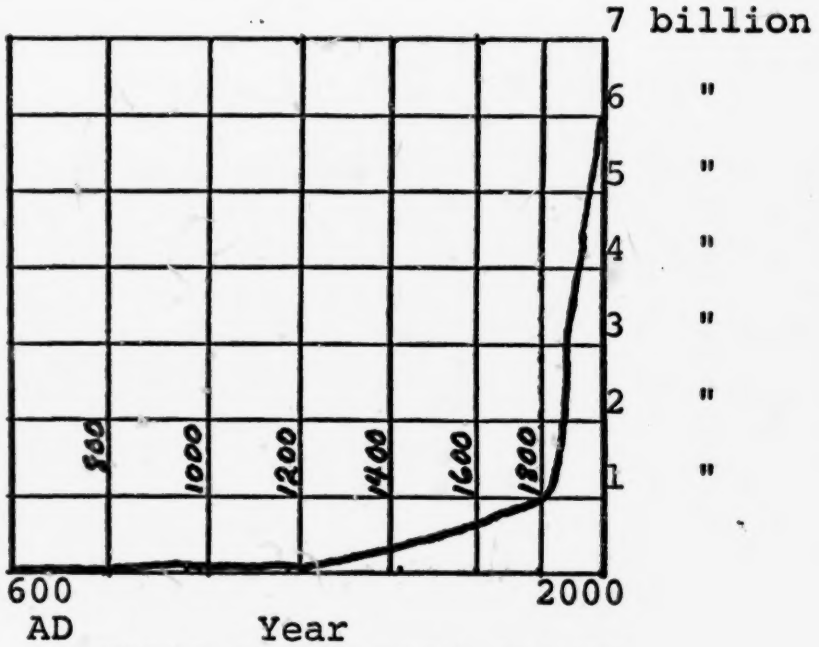
SPACE ENOUGH? (POPULATION)

"Woe unto them that join house onto house, that lay field to field, til there be no place that one may be placed alone in the midst of the earth."

Isaiah 5:8

Our planet is getting overcrowded. There is an urgent race for space -- a race we seem to be losing with a daily increase in population density. Just how many people can our finite planet support -- support in a way that is not dehumanizing?

The world population is increasing at the rate of nearly 50 million persons per year. Population increase results when the number of births exceeds the number of deaths for a given period of time. It is estimated that about 270,000 babies are born in the world each day. And each day 142,000 people die. That is a net increase of 128,000 people per day. A rate of this proportion is like adding a city the size of Japan every 14 months. Where will this lead us? Population experts estimate our present population to be three billion and predict that it will reach six billion by the year 2000.



WORLD POPULATION GROWTH

If there is a limit to the number of people this planet can hold, what is that limit? When will we reach it? When we do reach it, will it be too late to do anything about it?

THE TIME TO THINK AND PLAN AND ACT IS NOW.

"In this last third of the Twentieth Century, one of our most critical problems is pressure from an expanding population which threatens the high quality of our environment."

-- Richard M. Nixon

NATIONAL POLICY ON THE ENVIRONMENT NEEDED

Secretary of the Interior Udall said: "Life worth living is dependent on an environment worth living in. When our lives cease to harmonize with our environment, the resulting discord can shake

a person or a whole society. Rather than continually trying to adjust environment to a growing population the quality of the environment should be determined and standards set for quality of water, air, soil, and the density of population. Clear statements have been made by Congress in the fields of civil rights, education and full employment-- but no comprehensive national policy on the environment has been made."

"The spread of housing over good farm land, winter deer range, over flood plains which are a part of rivers, and on areas which are rain absorptive areas, calls for an evaluation of community planning", says Dr. Mulaik of Utah Nature Study Society.

WHO PLANS A CITY?

City planners, architects, engineers, economists, law enforcement specialists, traffic and transportation experts, educators, lawyers, social workers, political scientists and ALSO psychologists, anthropologists, and ethologists. What do YOU know about "who plans a city?"

TEACHING TIPS ON POPULATION

1. How does crowding affect plants?
Plant several seeds of one kind of plant two inches apart in a large flower pot. Plant the same kind of seeds one inch apart,1/2inch apart and 1/4 inch apart in the same size flower pots. Be sure that all the pots have the same soil, the same light conditions and the same moisture conditions. In which pot do the most plants sprout? In which do the most plants live long enough to bear seeds? In which pots are the strongest plants? the tallest?

2. What is the effect of crowding on grasshoppers?
In the spring catch a number of young grasshoppers. In one container with space, food, and water place only two grasshoppers. In the other container keep a large number of grasshoppers in a crowded condition, but well supplied with food and water. As the young grow into adults can you find any difference in the appearance or behavior of the adults in the crowded container and the adults in the spacious container?

3. What is the potential number of plants one plant is capable of producing in a year?
On a Norway maple, sycamore or milkweed plant have each of the children count the number of seeds in one fruit. Find the average number of seeds per fruit. Then count or estimate the number of fruits on the plant. How many seeds does that one plant bear that year? If all those seeds sprouted and grew, what would happen to the school yard? to the town? Why don't all the seeds sprout and grow? What percentage of the seeds do find a suitable place to grow? How many young plants of the same kind can you find in the yard?

4. With the students, plan a town or discuss how to plan a town of ten thousand "from scratch". Consider the requirements of such a

town - especially varieties of housing, public buildings, industry, roads, recreation, even space and room for expansion. Try making a relief map (3 dimensional) or a contour map of your town site. Decide which natural features of the landscape are best suited for building and which features of the landscape you want to keep intact. Make the buildings which are to be used in the town and try different arrangements of these buildings on the land. Which arrangement gives the inhabitants of the town the best environment for living? What problems would arise if the population of the town were to suddenly double due to a new industry being located there?

NOISE --A GROWING PROBLEM

Noise, which is really unwanted sound, is a pollutant of our environment just as much as air and water pollution are, damaging our health and lowering the quality of our lives. Noise occurs all day long--at home, on the way to work, at work, and during recreation. As population increases and industry expands and there is more time for noisy leisure activities, there will be more and more noise.

SOME SOUND EFFECTS

We are affected by the sounds we cannot hear as well as by those we do hear. Ultrahigh frequency sounds are used to clean rust off metals, to penetrate and seek out flaws in steel and to perform special surgery. Ultralow frequencies can create dangerous resonances in rooms. The low frequency of 7 cps (cycles per second) has been found to so affect the brain that it makes thought impossible. The French are now working on a military weapon which by low frequency sound will be able to kill a man five miles away.

Audible noise can cause temporary hearing loss, permanent hearing loss, raise blood pressure, interfere with communication, lower efficiency, trigger ailments like stomach ulcers and allergies, and is the main cause of loss of sleep. Of the sounds we can hear, those which are the loudest (highest on the decible scale) and those which last the longest are the most damaging.

DECIBEL SCALE

LETHAL TO SMALL ANIMALS	160	
EARDRUM RUPTURES	140	Jet taking off
PAINFUL TO HEAR	120	Siren
DEAFENING	100	Thunder Motorcycle
VERY LOUD	80	Food blender
LOUD	60	City playground Traffic
MODERATE	40	Quiet neighborhood
FAINT	20	Whisper at 4 feet
ABLE TO HEAR	0	Rustling of leaves, Breathing

The SONIC BOOM is the loud bang caused by supersonic transports. The bangs last only a fraction of a second, come in pairs, and are as loud as a medium size explosion in the next block. The suddenness, rather than the loudness, bothers people. The sudden change in air pressure that accompanies the boom causes property damage--plaster cracks, broken window glass, rocking foundations, (shell dome construction is especially vulnerable). Prehistoric cliff dwellings and the natural landscape as well, in two national parks, have been damaged by sonic booms. The SST (supersonic transport) being built by Boeing and backed by Federal funds, together with similar projects by British, French, and Russians, will create a new kind of pollution--a worldwide <u>sonic pollution</u>.

WHAT TO DO ABOUT NOISE POLLUTION

Laws and local ordinances are fairly permissive, not well enforced, and fines are too small to be a deterrent. (The city of Poughkeepsie just passed an anti-noise ordinance last July with fines not more than $100). Since 1957 Chicago has had a zoning ordinance which establishes maximum permissible sound levels which manufacturing districts can produce at their boundaries with residential or commercial districts.

Industry has recently been building equipment with noise suppression in mind. The FHA has set impact-noise rating in its minimum property standards and is fieldtesting effectiveness of new soundproofing materials and techniques. The ordinary homeowner can use sound-deadening construction materials and methods such as double walls, staggered studs, insulation, carpets, sound absorbent ceilings, pipe-wrapping, etc.

Complaints are increasing and hundreds of law suits against aircraft noise are pending throughout the country. Federal government efforts to solve the problem are now coordinated by the interagency Federal Aircraft Noise Abatement Program. A natural environment panel is studying the effects of noise and sonic boom on domestic and wild animals and on the fragile formations which exist in so many national parks. The new Miami, Florida jet-port now under construction will be bordered by a mile-wide buffer zone in which no construction will be allowed and in a three-mile zone beyond that only soundproofed apartments and hotels. Sweden and Canada have legislation or ordinances against sonic booms. A 35 decibel standard for night noise is recommended in Great Britain, but even residential areas with local traffic are over 40 decibels. New legislation in the U.S. requires FAA to establish and enforce noise regulations including curbs on sonic booms.

TEACHING TIPS ON NOISE

1. What materials can be used to transmit sound most quietly over a homemade telephone?

Make a "telephone" with two tin cans and a piece of string 6 to 14 feet long. On the bottom of each can punch a small hole in the center, insert the two ends of the string through these holes, and knot the ends securely inside. The cans are held apart so that the string is kept taut, one person speaks into one can while the other person holds the open end of can to his ear. Try different types of string, thread, rope, waxed string, or hollow straws to compare sound transmission. Try methods which will prevent obvious sound transmission through the air. Test it indoors and outdoors.

2. How does your community sound?

Run a tape recorder for 3 or 4 minutes, recording various kinds of noise at selected sites such as a playground, a quiet residential street, a busy intersection, a gas station, a construction site, and running motor scooters. In the classroom play back the sounds of the community, discussing with the class the desirability of the sounds, the need for change, how to affect change if one is necessary.

3. Do people make themselves heard more clearly above a noise level or below?

With a record or other object create a sound of about 80 decibels-loud enough so you have to shout to be heard. Have the children try talking to each other above the noise level by raising their voices. Then have them try to talk to each other below the noise by lowering their voices below the level of the noise. Decide which is more effective.

4. How can you make your home a quieter place?

With a large cardboard box make a "house". When a child is in the house make a noise outside the house. Use a drum or gong. Then insulate the "house" with various materials such as wool blankets, cotton blankets, newspapers, piles of books or make another, bigger box to fit over the "house" box. Which material keeps the sound out the best? Try this with other kinds of "houses". Clean metal or plastic garbage cans, wood, or other materials might be tested.

5. How does sound affect fruit flies?

Place some fruit flies or other small winged insects into a large wide-mouthed jar. Place a speaker over or in the jar, then seal it. By piping sounds of various frequencies and loudness into the jar you may observe how sounds affect the flies as well as what frequencies and volumes have the most effect. A good record to use for this experiment is the "Sounds of Frequency" by Folkways/Scholastic Records.

VISUAL POLLUTION

Visual Pollution is another name for an eyesore. No one likes to look at a junk yard nor a boarded up decaying building. But the problem is deeper than these. Scientists are becoming more aware of the effects of our surroundings upon our health and well being. Hospitals make an effort to paint their walls with colors that are soothing. This helps the patient recover quickly. Some scientists feel that urban children are often frightened when taken to the country because they have become so accustomed to the straight lined simplicity of modern city construction that the complexity of line in nature is confusing. Yes, we are affected by what we see. A messy room may be discouraging - so too is a messy town. We Americans are so container happy, everything must have a bright new box preferably of plastic. But what do we do with them? No longer do we return bottles for deposit (which assured their being picked up). Now everything seems to be disposable, no return and so it is just tossed aside and often left on the street. Paper will decay but plastic will not so it remains indefinitely.

Our automobiles are piling up in junk yards - for what use? Bill boards deface the country's vistas. How are we to learn to enjoy the natural beauty given to everyone free for the looking if it is cluttered with the symbols of our country's material prosperity. If each individual took care not to make a mess we would not need to spend millions on clean up campaigns.

TEACHING TIPS ON VISUAL POLLUTION

1. What does your community look like? Take photographs of several areas in your community where there is an accumulation of litter. Compare them in class and discuss improvement.

2. Find out what laws your town may have about waste disposal. Recommend where to place litter baskets. Follow this with a school campaign to encourage the use of these litter baskets.

3. What happens to old cars that have been damaged in an accident or that no longer work? Is there anything in a car that can be used again? What would happen if we just left them on the street?

4. Why do we have billboards - what is good about them, what is bad? What would happen if everyone put up a billboard? Do all countries in the world use billboards? What else could they use? Would you rather look at a field of cows or a woodlot or at a series of billboards advertising food etc.?

5. What effect does cutting all the trees in an area have on the soil, the air, the water, us? What happens to all the stumps? When a new road is built, why do they plant grass and trees?

6. What could we do to make our school more attractive?

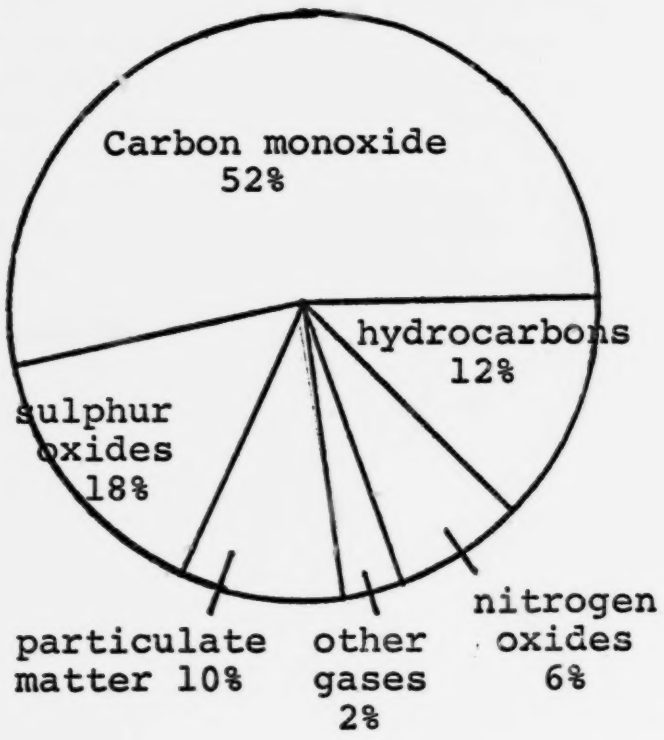
AIR POLLUTION: WHAT IS IT?

Air pollution includes the addition of materials to the air in our environment which affects health and property adversely. Air is contaminated by gases, particles, noise, pollen, radiation, and more things not yet identified. The seriousness of air pollution increases daily with our bulging population and concentration of people in large cities.

Air pollution studies fit into the curriculum at all levels and in such areas as health, science, social studies.

AIR POLLUTION IN THE UNITED STATES
(125 million tons per year)

TYPE OF POLLUTANT



taken from NEWS FOCUS
October 20, 1967

SOURCE OF POLLUTANT

59.9% Transportation
Trucks, automobiles and buses powered by internal combustion engines are the major emitters of carbon monoxide, hydrocarbons and oxides of nitrogen. Photo chemical smog--new compounds are formed when sun shines on hydrocarbons and nitrogen dioxide.

12.5% Generation of electricity by burning coal and oil produces sulfur oxides

18.7% Industry is the principal contributor of particulate matter, the part of fuel that cannot burn

6.3% space heating

2.6% refuse disposal

LET'S HAVE A LAUGH!

Worried Teacher (after reading about air pollution) says to her class: "You can breathe as long as you don't inhale."

TEACHING TIPS ON AIR POLLUTION

IS THE AIR IN YOUR NEIGHBORHOOD POLLUTED?

1. Expose slides covered with a thin layer of petroleum jelly. Compare them after 1 hour, 1/2 day, 3 weeks.

2. Trap particles in a cloth filter from automobile exhaust by tying a piece of clean muslin over the exhaust pipe and running the engine for two minutes.

3. Expose white tissues to the air for varying lengths of time noting wind, weather, etc.. Note variations in whiteness of snow around school yard.

4. Observe your local dump in action.

5. Identify sources of air pollutants (automobiles, factories, furnaces) in your neighborhood. Photograph them.

Air Pollution films are available from New York State Department of Health Film Library.

Tom Lehrer Sings "Pollution"
With Each Breath
The First Mile Up
Air Pollution in the News
Ill Winds on a Sunny Day
Moto Gaz
Take a Deep Breath
Air Pollution, Everyone's Problem
Our Air

WATER POLLUTION

Water is a limited resource. It is used over and over again. As industry grows and people increase, more and more water is used. If we contaminate it, we have less and less for our use. There are many ways in which water becomes contaminated or polluted. Detergents, oil, pesticides, herbicides or "weed killers", chemical fertilizers, chemicals from factory wastes, untreated sewage, salt and debris from streets, silt and refuse. Without water no living thing on this planet could exist, so let us use it wisely.

WASTES IN WATER

A typical city of 100,000 produces daily:

1 ton of detergents
17 tons of organic suspended solids
16 tons of organic dissolved solids
8 tons of inorganic dissolved solids
60 cubic feet of grime

WATER POLLUTION PAMPHLET --"Clean Water - It's up to You" analyzes present pollution problems and has detailed descriptions of how concerned citizens can take action. Free copies may be obtained from: Izaak Walton League of America, 1326 Waukegan Road, Glenview, Illinois 60025.

TEACHING TIPS ON WATER

1. Is water an essential part of living things?
Use one cool dry test tube for each object to be tested. Place a piece of wood, root, soil, grass, bark or other object in the bottom of a test tube. Light a match under the object in the test tube. If there is water, vapor will form on the inside of the test tube. For a control, follow the same procedure with an empty test tube. Is there any water in a dead leaf? a piece of bread? a seed?

2. How much water is present in food?
In order to find out, weigh one of several substances such as an apple, an ear of corn or a potato. After recording the weight, cut the object into pieces and place it in a warm place, such as the top of a radiator, to dry for a few days. Weigh the object again after it is dry. Subtract the final weight from the original weight to obtain the weight of water loss. This can be converted into the percentage of water in the substance.

3. What is the most use you can make of one gallon of water?
Start with a gallon of clean water. Have the children develop a sequence of activities using the same water over and over again until it is either used up or too dirty to be reused. (suggested by Dorothy Mulaik)

4. How much water is wasted by a dripping faucet?
Place a cup under a dripping faucet. How much water collects in the cup in one hour? What would collect in a day? a week? a year? Suppose the drip occurs in each apartment of an apartment house where four hundred families live. How much water could be lost in a day? a week? a year?

5. How well can your senses distinguish the difference between several samples of water?

A. Can you detect the chemicals in the water?
   1. Compare four ounces of well water, municipal water, swimming pool water by first smelling, then tasting each, (Note: the sense of smell fatigues quickly.) Why do the waters smell different?
   2. Add a Halazone tablet to four ounces of well water. Which of the other waters does its taste resemble? Which does its smell resemble? Why was one kind of water (municipal) treated and the well water not treated?

B. Can you distinguish between water <u>with</u> air and water <u>without</u> air (flat)?
   1. Taste some cooled boiled water. Compare with the taste of sample of this same water after pouring it back and forth from one cup into another in order to incorporate air. Which tastes better to you?
   2. Taste some water which has been standing a week or two uncovered. Compare with the taste of a sample of water freshly drawn from the tap. Which tastes better to you?

6. How does sunlight affect the green water plant Elodea? (Anacharis) Get a piece of Elodea, a plant commonly used in aquaria. Break off the growing tip of the plant and place it in a test tube of water, cut side up. Place in sunshine and observe the oxygen bubbles. Place in the shade. Is there any difference? Look for bubbles in pools or ponds outside your school. Investigate to see if Elodea or some other plants are present where the bubbles are. (Animal dependence upon green plants for oxygen should be brought out.) An investigation into the amount of useable oxygen in the water can be made using the following as a guide. A rough indicator of the oxygen content of water, hence of the pollution, are the organismsfound living in the stream or pond. As a general rule, the greater the variety of animals living in the water, the less the pollution.

OXYGEN CONTENT	ANIMALS	PLANTS
High	Gamefish-Trout, Bass Bluegills, Perch	Aquatic mosses and liverworts, pond weeds and waterwort (Elatine)
	Carp, Suckers	Green Algae, Duckweed
	Bloodworms, Leeches, Snails	Masses of Green Algae, Duckweed, Water Milfoil
Low	No Animals	Blue-green Algae

KEEPING UP-TO-DATE

Audubon, National Audubon Society, 1130 Fifth Avenue, New York, N.Y. $10.00, bimonthly includes membership in National Audubon Society.

A Bulletin on Conservation Education, Conservation Foundation, 1250 Connecticut Avenue, N.W., Washington, D.C. 20036. Quarterly (free).

The Conservationist, State of New York Conservation Dept., Room 339, State Campus, Albany, N.Y.12226. 6 issues $2.00/year, $1.00 schools.

Conservation News, National Wildlife Federation, 1412 16th Street N.W., Washington, D.C. 20036. 24 copies (free).

Curious Naturalist, Massachusetts Audubon Society, Lincoln, Mass. 01733. 10 issues $2.00 (bulk rates also available).

Environment (formerly Scientist and Citizen), Committee for Environmental Information, 438 N. Skinker Blvd., St. Louis, Missouri 63130. 10 issues 1 year $6.00 (group rates available).

Environmental Education News, Information and Education Division, Michigan Department of Natural Resources, Lansing, Michigan 48926.

National Wildlife, National Wildlife Federation, 381 W. Center Street, Marion, Ohio 43302. $5.00 bimonthly includes membership.

Natural History, The American Museum of Natural History, Central Park West at 79th Street, New York, N.Y. 10024. 10 issues $7.00 yearly.

Nature and Science. Natural History Press, Garden City, N.Y. 11531. $3.50 per year, 18 issues (bulk rate $1.95 per school year).

Nature Study. The American Nature Study Society, RD #1, Homer, N.Y. 13077. $5.00 4 issues includes membership in ANSS.

Population Bulletin. Population References Bureau Inc., 1755 Massachusetts Ave., N.W., Washington D.C. 20036. Free.

Resources, Resources for the Future, Inc., 1755 Massachusetts Ave., N.W., Washington D.C. 20036. 3 issues free.

Science and Children. The National Science Teachers Association, 1201 Sixteenth Street N.W., Washington D.C. 20036. $4.00 per year 8 issues.

Science News. Science Service, 1719 North St.N.W., Washington, D.C. 20036. $7.50 per year. Weekly.